SRNT

(Technical Data)

Surface Roughness

Excerpt from JIS B 0601 (1994) and JIS B 0031 (1994)

1. Categories of Surface Roughness

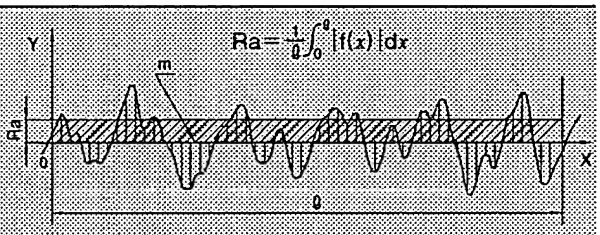
Definitions and indications for surface roughness parameters for industrial products are specified. They are arithmetical mean roughness (Ra), maximum height (Ry), ten-point mean roughness (Rz), mean spacing of profile irregularities (Sm), mean spacing of local peaks (S) and profile bearing length ratio (tp). Surface roughness is given as the arithmetical mean value for a randomly sampled area. (Mean center line roughness (Ra_{75}) is defined in the annexes of JIS B 0031 and JIS B 0601).

Typical ways for obtaining surface roughness

Arithmetical Mean Roughness Ra

A section of standard length is sampled from the mean line on the roughness chart. The mean line is laid on a Cartesian coordinate system wherein the mean line runs in the direction of the x-axis and magnification is the y-axis. The value obtained with the formula on the right is expressed in micrometer (μm) when $y=f(x)$.

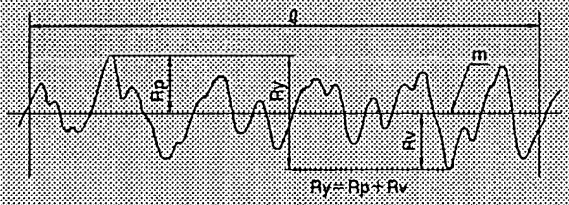
$$Ra=\frac{1}{Q}\int_0^Q |f(x)|dx$$



Maximum Peak Ry

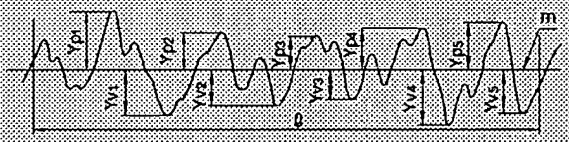
A section of standard length is sampled from the mean line on the roughness chart. The distance between the peaks and valleys of the sampled line is measured in the y direction. The values expressed in micrometer (μm).

Note To obtain Ry, sample only the standard length. The part, where peaks and valleys are wide enough to be interpreted as scratches, should be avoided.



Ten-Point Mean Roughness Rz

A section of standard length is sampled from the mean line on the roughness chart. The distance between the peaks and valleys of the sampled line is measured in the y direction. Then, the avarage peak is obtained among 5 tallest peaks (Yp), as is the average valley between the 5 lowest valleys (Yv). The sum of these two values is expressed in micrometer (μm).



$$Rz=\frac{|Yp_1+Yp_2+Yp_3+Yp_4+Yp_5|+|Yv_1+Yv_2+Yv_3+Yv_4+Yv_5|}{5}$$

$Yp_1, Yp_2, Yp_3, Yp_4, Yp_5$: Altitudes of the five highest profile peaks of the sampled portion corresponding to the reference length Q.

$Yv_1, Yv_2, Yv_3, Yv_4, Yv_5$: Altitudes of the five deepst profile bottoms of the sampled portion corresponding to the reference length Q.

Reference : Relationship between arithmetic mean roughness (Ra) and conventional symbols

Arithmetical Mean Roughness Ra			Maximum Peak Ry	Ten-Point Mean Roughness Rz	Base Length of Ry and Rz	Triangular Indication
Standard Series	Cut-Off Value λc(mm)	Graphical Representation of Surface Texture	Standard Series		Q (mm)	
0.012 a 0.025 a 0.05 a 0.1 a 0.2 a	0.08 0.25	0.012 ~ 0.2	0.05 s 0.1 s 0.2 s 0.4 s 0.8 s	0.05 z 0.1 z 0.2 z 0.4 z 0.8 z	0.08 0.25	
0.4 a 0.8 a 1.6 a	0.8	0.4 ~ 1.6	1.6 s 3.2 s 6.3 s	1.6 z 3.2 z 6.3 z	0.8	
3.2 a 6.3 a	2.5	3.2 ~ 6.3	12.5 s 25 s	12.5 z 25 z	2.5	
12.5 a 25 a	8	12.5 ~ 25	50 s 100 s	50 z 100 z	8	
50 a 100 a	—	50 ~ 100	200 s 400 s	200 z 400 z	—	

※The interdependence for 3 classes is not strictly enforced.

※Ra : The evaluated length values of Ry and Rz are 500% of the cut-off value and reference length, respectively.

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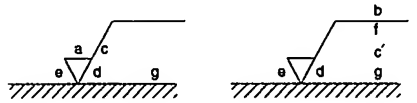
Grain Graphic Indications

Excerpt from JIS B 0031 (1994)

1. Indication of Each Grain Surface

This includes surface roughness, cut-off value of reference length, processing method, symbol of direction of lay, surface waviness, etc.

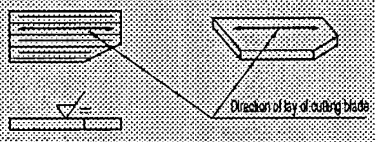
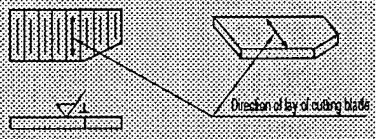
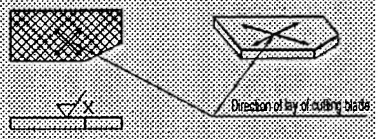
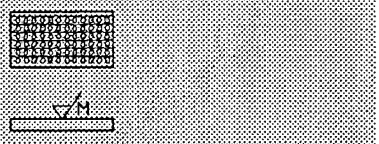
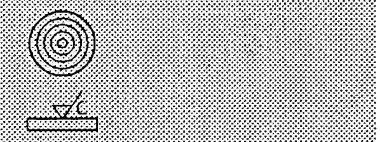
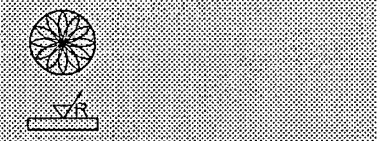
Fig. 1. Indication of Each Grain Surface



a : Ra value
b : Processing method
c : Cut-off value · Evaluation length
c′ : Reference length · Evaluation length
d : Symbol of direction
f : Parameter other than Ra (With tp, parameter/cutoff point.)
g : Surface waviness (according to JIS B 0601)

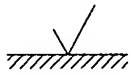
Reference Items other than a and f are added as necessary.

For reference ISO 1302 stipulates that a finish allowance be entered at the e position in Fig.1.

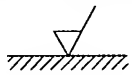
Symbol	Meaning	Figure
=	Parallel to the projected surface on which the direction of lay of the cutting blade is indicated. Ex. Shaping surface	
⊥	Perpendicular to the projected surface on which the direction of lay of the cutting blade is indicated. Ex. Shaped surface (viewed from the side) Turned cylindrically ground surface	
X	Intersection of two diagonal lines on the projected surface on which the direction of lay of the cutting blade is indicated. Ex. Honing finished surface	
M	Multidirectional intersection or non-directional part on the projected surface on which the direction of lay of the cutting blade is indicated. Ex. Lapping finished surface, super finished surface, face-milled surface by cross feeding or end-milled surface	
C	Concentric circles roughly centered on the same point on the surface on which the direction of lay of the cutting blade is indicated. Ex. Faced surface	
R	Machined lays are spread in almost radial pattern from the center of the surface on which the symbol has been entered.	

■Examples Grain Graphic Indications

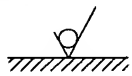
Instruction symbol for surface



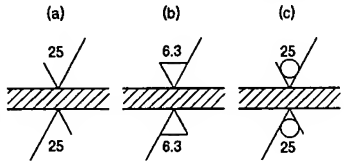
Indicates surface requiring surface work



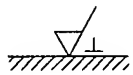
Indicates surface not applicable for surface work



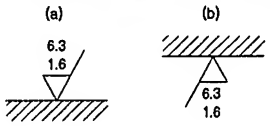
Examples of Ra upper limit indications



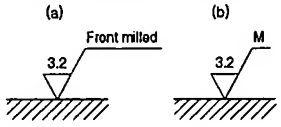
Example of direction of lay



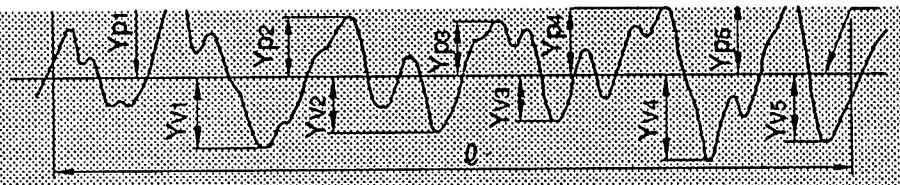
Examples of Ra upper · lower limit indications



Example of processing method indication



A section of standard length is sampled from the mean line on the roughness chart. The distance between the peaks and valleys of the sampled line is measured in the y direction. Then, the avarage peak is obtained among 5 tallest peaks (Yp), as is the average valley between the 5 lowest valleys (Yv). The sum of these two values is expressed in micrometer (μm).



$$Rz = \frac{|Yp_1 + Yp_2 + Yp_3 + Yp_4 + Yp_5| + |Yv_1 + Yv_2 + Yv_3 + Yv_4 + Yv_5|}{5}$$

Yp_1、Yp_2、Yp_3、Yp_4、Yp_5 : Altitudes of the five highest profile peaks of the sampled portion corresponding to the reference length ℓ.

Yv_1、Yv_2、Yv_3、Yv_4、Yv_5 : Altitudes of the five deepst profile bottoms of the sampled portion corresponding to the reference length ℓ

Reference : Relationship between arithmetic mean roughness (Ra) and conventional symbols

Arithmetical Mean Roughness Ra			Maximum Peak Ry	Ten-Point Mean Roughness Rz	Base Length of Ry and Rz ℓ (mm)	Triangular Indication
Standard Series	Cut-Off Value λc(mm)	Graphical Representation of Surface Texture	Standard Series			
0.012 a	0.08	0.012 ~ 0.2	0.05 s	0.05 z	0.08	▽▽▽▽
0.025 a	0.25		0.1 s	0.1 z		
0.05 a			0.2 s	0.2 z	0.25	
0.1 a			0.4 s	0.4 z		
0.2 a			0.8 s	0.8 z		
0.4 a	0.8	0.4 ~ 1.6	1.6 s	1.6 z	0.8	▽▽▽
0.8 a			3.2 s	3.2 z		
1.6 a			6.3 s	6.3 z		
3.2 a	2.5	3.2 ~ 6.3	12.5 s	12.5 z	2.5	▽▽
6.3 a			25 s	25 z		
12.5 a	8	12.5 ~ 25	50 s	50 z		▽
25 a			100 s	100 z	8	
50 a		50 ~ 100	200 s	200 z		~
100 a	–		400 s	400 z	–	

※The interdependence for 3 classes is not strictly enforced.

※Ra : The evaluated length values of Ry and Rz are 500% of the cut-off value and reference length, respectively.

e.g. 100S ↔ 100μm (max.) Ry with Ra ∈ (12.5 ~ 25μm)

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